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***Retrospective Study***

**Ursodeoxycholic acid combined with percutaneous transhepatic balloon dilation for management of gallstones after elimination of common bile duct stones**

Chang HY*et al.* PTBD for Management of gallstones

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**Abstract**

***AIM***

To evaluate the effectiveness and safety of combined ursodeoxycholic acid and percutaneous transhepatic balloon dilation for management of gallstones after expulsion of common bile duct (CBD) stones.

***METHODS***

From April 2014 to May 2016, 15 consecutive patients (6 men and 9 women) aged 45-86 (mean, 69.07 ± 9.91) years suffering from CBD stones associated with gallstones were evaluated. Good gallbladder contraction function was confirmed by type B ultrasonography. Dilation of the CBD and cystic duct was detected. Percutaneous transhepatic balloon dilation of the papilla was performed, ursodeoxycholic acid was administered, and all patients had high-fat diet. All subjects underwent repeated cholangiography, and percutaneous transhepatic removal was carried out in patients with secondary CBD stones originating from the gallbladder.

***RESULTS***

All patients underwent percutaneous transhepatic balloon dilation with primary success rate of 100%. The combined therapy was successful in 86.7% of patients with concomitant CBD stones and gallstones. No remaining stones were detected in the gallbladder. Transient adverse events include abdominal pain (*n* = 1), abdominal distension (*n* = 1), and fever (*n* = 1). Complications were treated successfully *via* nonsurgical management without long-term complications. No procedure-related mortality occurred.

***CONCLUSION***

For patient with concomitant CBD stones and gallstones, after percutaneous transhepatic removal of primary CBD stones, oral ursodeoxycholic acid and high-fat diet followed by percutaneous transhepatic removal of secondary CBD stones appear to be a feasible and effective option for management of gallstones.

**Key words:** Common bile duct stones; Gallstones; Percutaneous transhepatic removal; Ursodeoxycholic acid

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**Core tip:** Percutaneous transhepatic removal combined with oral ursodeoxycholic acid and high-fat diet appear to be a feasible and safe alternative to surgery or endoscopic procedure for elimination of gallstones, especially for patients with good gallbladder contraction function, diameter of gallstone no greater than 12 mm, and dilation of cystic duct. It also provides an alternative when operative management is not available for patients in poor condition.

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**INTRODUCTION**

Bile duct stones are the major cause of benign biliary diseases[1]. Surgical exploration or endoscopic intervention can be managed successfully in most common bile duct (CBD) stones[2]. However, open surgery is contraindicated in cases with severe comorbidities, and endoscopic sphincterotomy (EST) for extraction of CBD stones in patients with prior surgically modified gastrointestinal tract may result in failure due to invisibility of the papilla of Vater[3]. Hence, percutaneous transhepatic intervention appears to be an alternative for these patients. To prevent the recurrence of CBD stones for patient with concomitant CBD stones and gallstones, subsequent cholecystectomy is the first choice after the elimination of CBD stones within 48 h[4]. Herein, we present our experience in percutaneous transhepatic removal of stones for patients with CBD stones associated with gallstones *via* an innovative nonsurgical treatment including percutaneous transhepatic balloon dilation (PTBD) combined with oral ursodeoxycholic acid. Moreover, this study aimed to assess the efficacy and safety of this combined therapy.

**MATERIALS AND METHODS**

This was a retrospective study to assess the efficacy and safety of PTBD combined with ursodeoxycholic acid for removal of CBD stones associated with gallstones. The procedure was approved by the ethics committee of our institution. Written informed consent was obtained from all patients.

***Patients***

Fifteen consecutive patients (6 men and 9 women) aged 45-86 (mean, 69.07 ± 9.91) years, diagnosed with concomitant CBD stones and gallstones, admitted to our institution from April 2014 to May 2016 were evaluated.

Overall, 2-5 CBD stones and gallstones were detected in 15 patients, with diameters ranging 2-25 mm. Eleven patients were confirmed to have concomitant CBD stones and gallstones before procedure using type B ultrasonography, enhanced computed tomography, or magnetic resonance cholangiopancreatography (MRCP), and the remaining 4 were detected by cholangiography during the removal of CBD stones. All patients suffered from fever, jaundice, abdominal discomfort, poor appetite, or vomiting.

Ultrasonography, enhanced CT, MRCP, or cholangiography were carried out to determine the diagnosis of stones (Figure 1A and B). Pancreatitis was not detected. For patients with poor condition, multiple disciplinary consultations were carried out as pre-procedure assessment.

Follow-up of patients include clinic assessment, physical examination, laboratory test and imaging evaluation for 1 year at 3 mo interval. Technical success is defined as complete absence of CBD stones. The absence of symptoms is regarded as medical success regardless of the presence or absence of residual stones.

***Procedure***

### After pretreatment with antibiotics (levofloxacin or [cephalosporin](file:///C:\Users\wwei0125\AppData\Local\youdao\DictBeta\Application\7.1.0.0421\resultui\dict\?keyword=cephalosporin)), all patients were positioned under intravenous sedation and fluoroscopic monitoring, and a 21G Chiba needle ([Neff Percutaneous Access Set](https://www.cookmedical.com/products/ir_npas_webds), Cook Medical LLC, Bloomington, IN, United States) was used to puncture the right hepatic duct. The biliary tree was shown by injecting contrast agent *via* the needle. A tiny guidewire (Wire Guide Diameter inch. 018, Cook Medical LLC, Bloomington, IN, United States) was introduced into the biliary system, and a sheath was inserted into the bile duct over the tiny guidewire. Advancing cholangiography was performed to detect the number, size, and location of stones (Figure 1C). A hydrophilic guidewire [150 cm in length, Terumo (China) Holding Co., Ltd. China] was deployed in the CBD *via* the transhepatic route. A 6F to 10F sheath [Terumo (China) Holding Co., Ltd. China] was introduced into the right hepatic duct according to the balloon size to dilate the papilla of Vater. A Vert catheter (Cook Medical LLC, Bloomington, IN, United States) was introduced into the duodenum or jejunum. A stiff guidewire [260 cm in length, Terumo (China) Holding Co., Ltd. China] was passed through the catheter and papilla of Vater. An angiographic catheter balloon was inserted through the stiff guidewire and was placed across the papilla. The diameter of the balloon varied from 12 mm to 24 mm and its length at 40 mm or 60 mm depending on the size of the stones (Figure 2). The papilla was inflated gradually until the maximal pressure reached 6-8 atm. Stone-crushing device such as a basket was used in some cases with large stones. Larger balloon was inserted to dilate the papilla in patients with primary failure, and stone expulsion was performed repeatedly. Intraoperative cholangiography was performed to confirm residual stones in CBD. An 8.5F external drainage tube ([Biliary Drainage Catheter](https://www.cookmedical.com/products/ir_ultclb_webds), Cook Medical LLC, Bloomington, IN, United States) was deployed in the CBD for postoperative drainage and assessment of efficacy of the procedure (Figure 3).

Oral ursodeoxycholic acid (250 mg, Losan Pharma GmbH) was initiated in all patients after procedure. The prescribed dose was 250 mg at three times a day. After 7-10 d, repeated cholangiography *via* external drainage catheter was performed, balloon dilation of the sphincter of oddi and elimination of stones was carried out in patients with secondary CBD stones (Figures 4 and 5). Intraoperative cholangiography confirmed the absence of all stones and external drainage tube was left (Figure 6A). Furthermore, 3-5 d after the procedure, cholangiography was performed again with no residual of stones, and the catheter was retrieved (Figure 6B).

## *Statistics analysis*

Data were reported as mean ± standard deviation. Comparison of mean was analyzed by paired t test. All statistical analyses were performed using IBM SPSS Statistics 24.0. *P* values < 0.05 were defined as statistically difference for all data.

**RESULTS**

Table 1 shows baseline characteristics of patients. Table 2 shows that complete clearance of CBD stones was obtained in one session for all patients. No plastic or bare mental stent was inserted in any patient. All patients were administered subsequently with oral ursodeoxycholic acid after undergoing PTBD. Secondary CBD stones originating in the gallbladder were detected in 13 of these patients with concomitant CBD stones and gallstones. The stones were eliminated in one session in all these patients. Gallstones with reduced size still existed in situ in the remaining two patients. One patient with residual gallstones with symptoms was transferred to department of general surgery for laparoscopic cholecystectomy. One asymptomatic patient was discharged. Intensive long-term follow-up was essential for them. No further treatment except for observation was carried out for this patient. No evidence of retained CBD stones was detected in any patients. The technical success rate is 86.7%, and the overall medical successful rate was 93.3%.

Table 3 demonstrates the result of laboratory test pre and postintervention. Serum alanine transaminase and total bilirubin (TBIL) levels became normal in patients with jaundice after the procedure. White blood cell (WBC) levels decreased significantly on day 14 postoperatively. However, there was no statistical difference between preoperative and postoperative values for hemoglobin and amylase.

Transient adverse effects including vomiting, chills, fever, and abdominal distension were found in a few patients after the procedure. They were cured with analgesic and antiemetic argent. No severe complications such as bile peritonitis, hemobilia, and cholangitis occurred. TBIL and WBC values of one patient complicated with fever were 63 µmol/L and 12.21 × 109/L, respectively, after the procedure. One patient suffered from abdominal distention and decreased hemoglobin levels from 122 g/L to 82 g/L. The WBC count increased slightly for patient complicated with abdominal pain. All complications were treated successfully *via* nonsurgical management without remote complications. Antibiotics (Ceftriaxone) and somatostatin were injected until the symptoms vanished. No procedure-related mortality occurred. During 1-year follow-up, no obstruction of bile ducts and recurrence of symptoms were detected.

**DISCUSSION**

Bile duct stones, as one of the most common digestive problems needing admission to hospital, are the major cause of benign diseases of the biliary tract, such as obstructive jaundice and cholangitis[1,5]. It includes intrahepatic and extrahepatic bile duct stones, CBD stones and gallstones. CBD stones comprised primary and secondary stones. Secondary stones from the gallbladder and migrating into the ductal system are different from primary stones that form in the biliary tract. Primary stones may be the consequence of bacterial infection and biliary stasis. The majority of the secondary stones are cholesterol gallstones, while primary stones are mainly pigment stones[6]. Compared to the western population, primary stones are more prevalent in Asia[7]. The prevalence of CBD stones in patients with symptomatic gallstones varies from 10% to 20%[8]. In this study, 15 patients with CBD stones suffered from gallstones, of which 11 were confirmed before the procedure, while 4 patients who underwent PTBD had gallstones detected by cholangiography.

Many people are hospitalized for acute pancreatitis due to CBD stones that occluded the ampulla. In addition, bile duct obstruction caused by stones result in septic cholangitis. Chronic occlusion could induce secondary biliary cirrhosis. All types of CBD stones should be cured aggressively. Many management options, including open surgery, laparoscopic surgery, endoscopic and percutaneous procedure, are available for removal of CBD stones[1,2,9-11]. Abdominal exploration with incision of the CBD and stone removal was the predominant choice a few decades ago. With technological advances and improvement of skills, various alternatives could be employed in the extraction of bile duct stones. However, open surgery still retains its important role in the management of complicated stone disease. Laparoscopic procedure has comparable morbidity and mortality rates to open surgery. Hence, both open and laparoscopic surgery should be considered in cases unsuitable to be treated by nonsurgical options.

Endoscopic retrograde cholangiopancreatography (ERCP) was first introduced in 1968[12]. It was accepted quickly as a feasible diagnostic and therapeutic technique for CBD stones[13,14]. In the 1990s, EST was considered a feasible alternative for patient with serious comorbidity contraindicated to open surgery[15,16]. It appears to be a better choice for elder patients with benign biliary tract diseases. CBD stones could be eliminated by ERCP *via* sphincterotomy or balloon dilation[17]. For patients requiring maintenance of papillary function, balloon dilation may be an effective and safe alternative to EST in the management of bile duct stones[18-20]. However, open surgery is superior to ERCP for clearance of CBD stones. Compared to open surgery, ERCP necessitates increased number of procedures for each patient[2]. Complications of ERCP with sphincterotomy include hemorrhage, papillary stenosis, pancreatitis, duodenal perforation, and recurrent stones[21], and the complication rate ranges 0.5%-5.4%[22].

In the past decades, percutaneous intervention has been reported as an effective alternative to open or laparoscopic surgery and endoscopic intervention for elimination of CBD stones[9,23,24]. Several reports indicated that transhepatic balloon dilation of papilla could be an alternative to extraction of biliary stones[23-25]. Numerous devices, such as Dormia basket, occlusive, or cutting balloon, were introduced to improve the success rate of the technique[25-27]. The technique success rate varies from 94.7% to 100%[28,29]. Papillary dilation was performed using balloons with diameter ranging from 8 mm to 20 mm[9,28,30]. Transient adverse events, including nausea, vomiting, and abdominal pain, were observed in some cases which resolved with medication composed with analgesic and antiemetic drugs. A study by Nevzat Ozcan revealed 18 complications, including cholangitis (2.7%), subcapsular biloma (1.5%), subcapsular hemotoma (0.38%), subcapsular abscess (0.38%), bile peritonitis (0.38%), duodenal perforation (0.38%), and CBD perforation (0.38%)[9]. Only 2 of 38 main complications were observed by Santiago Gil with complete expulsion of stones in 36 of the 38 patients. No procedure-related deaths occurred[29]. Although a few cases were reported, ERCP for patient with prior Billroth II gastrectomy may be challenging[26,31,32]. EST for extraction of CBD stones may lead to failure, even in experienced surgeon[33]. For these cases, percutaneous transhepatic intervention appears to be an available and safe management for expulsion of stones[34].

Several other methods for percutaneous expulsion of stones to the duodenum were reported. Extraction from the T-tube or existing gallbladder drain for access has been published as an effective percutaneous technique for stone expulsion[30,35]. A novel technique of combined percutaneous transhepatic and endoscopic or laparoscopic approach also acts an important role in patients unsuitable to be treated with routine ERCP[36-38].

Gallstones with a higher prevalence in adults may occur in all societies and races. Its increasing prevalence associates with age in both sexes, and women are involved more commonly than men[6]. Gallstones are composed of cholesterol, calcium bilirubinate, protein, lipid, and less water. Occlusion of the gallbladder duct can cause abdominal pain, chills, fever, and jaundice. Treatment is indicated in patients with symptomatic gallstones. Cholecystectomy is the most effective procedure for symptomatic patients[39]. Laparoscopic, small-incision, or open cholecystectomy could be a feasible treatment in the management of gallstones. These three techniques can resolve symptoms caused by gallstones. No statistically significant differences in the outcome have been found. Although laparoscopic cholecystectomy is the most popular method, small-incision cholecystectomy has a shorter operative time and appears to be less costly[40]. However, the increased incidence of colon cancer is associated with cholecystectomy[41]. Several nonsurgical treatments have been developed for treatment of gallstones with recurrence. Percutaneous cholecytostomy serves a role with few complications in management acute calculous cholecystitis[42,43]. Medical treatment also plays an important role in management of gallstones. Gallstone dissolution may be achieved by oral administration of ursodeoxycholic acid which decreases biliary cholesterol secretion, increases solubility of cholesterol by formation of liquid crystals, and reduces intestinal cholesterol absorption[39].

To prevent the recurrence of stones, for CBD stones associated with gallstones, subsequent cholecystectomy is the first choice after the elimination of the CBD stones within 48 h[4]. Patients with suspected or proven CBD stones undergoing cholecystectomy can anticipate benefit from the perioperative management of CBD stones[11]. Nowadays, several procedures depending on the experience of surgeon are available for treatment of combined cholecystocholedocholithiasis, such as laparoscopic treatment, simultaneous laparoendoscopic treatment, and combined ERCP and EST with cholecystectomy[44]. Concurrent transhepatic percutaneous balloon dilation combined with laparoscopic cholecystectomy is introduced for treatment of gallstones associated with CBD stones[38]. Fifteen patients with concomitant CBD stones and gallstones enrolled in our study, the primary technical success rate was 100%. Subsequently, PTBD was performed repeatedly to expel secondary CBD stones originating in the gallbladder. Immediate complications include bile peritonitis, bile pleura effusion, hemobilia, acute pancreatitis, and duodenum perforation, were not observed in our study. All slight complications were treated successfully *via* nonsurgical management.

In our series, fifteen patients with CBD stones and gallstones were enrolled and 13 of them were treated successfully *via* an innovative technique. For these patients, the strategy of treatment was as follows: First, routine PTBD was performed to eliminate the CBD stones without any difficulties. Then, all patients with good gallbladder contraction function were confirmed. Second, ursodeoxycholic acid, a kind of oral dissolution agent, was administered to patients with 250 mg for three times per day. High-fat diet was initiated similar to that in gallbladder contraction test. Third, repeated cholangiography was performed 7-10 d later, and 13 cases showed secondary CBD stones originating in gallbladder retaining in the CBD. Gallstones with reduced size still existed in situ in the remaining two patients. For patient with secondary CBD stones, subsequently PTBD was carried out repeatedly with great care, and the stones were expulsed into the duodenum. One asymptomatic patient with reduced gallstones was discharged directly with intending long-term follow-up. The remaining patient underwent cholecystectomy. 3-5 d later, cholangiography demonstrated no residual stones in all patients with secondary CBD stones, and the drainage tubes were removed.

In conclusion, PTBD is an option for patient with CBD stones. Percutaneous transhepatic removal combined with oral ursodeoxycholic acid and high-fat diet appear to be a feasible and safe alternative to surgery or endoscopic procedure for elimination of gallstones, especially for patients with good gallbladder contraction function, diameter of gallstone no greater than 12 mm, and dilation of cystic duct. It also provides an alternative when operative management is not available for patients in poor condition.

**ARTICLE HIGHLIGHTS**

***Research background***

Bile duct stones are the most frequent cause of benign bile duct disease. The choice of management of common bile duct (CBD) stones include surgical exploration, endoscopic intervention and percutaneous transhepatic intervention. Subsequent cholecystectomy is the first choice to prevent the recurrence of stones for patient with concomitant CBD stones and gallstones. This retrospective study aimed to evaluate the clinic efficacy and safety of ursodeoxycholic acid combined with percutaneous transhepatic balloon dilation for management of gallstones after elimination of CBD Stones.

***Research motivation***

Percutaneous transhepatic intervention served as an effective option for management of CBD stones in the past decades. The preferable choice of management for patients with concomitant CBD stones and gallstones is controversial.

***Research objectives***

The retrospective study evaluated the effectiveness and safety of a novel technique for management of gallstones after expulsion of CBD stones in terms of technical success, postoperative complications.

***Research methods***

Fifteen consecutive patients diagnosed with concomitant CBD stones and gallstones were evaluated. All patients underwent application of ursodeoxycholic acid combined with percutaneous transhepatic balloon dilation for management of gallstones after elimination of CBD Stones. Clinic assessment, physical examination, laboratory test and imaging of all patients were assessed. All statistics analyses were performed using SPSS 24.0. *P* values < 0.05 were defined as statistically difference for all data.

***Research results***

The novel technique was successful in 86.7% of patients with concomitant CBD stones and gallstones with few postoperative complications treated successfully *via* nonsurgical management. It seemed to be an alternative to open or laparoscopic surgery and endoscopic intervention.

***Research conclusions***

The present study showed that ursodeoxycholic acid combined with percutaneous transhepatic balloon dilation was secure and feasible for management of gallstones after elimination of CBD Stones, especially for patients with good gallbladder contraction function, diameter of gallstone no greater than 12 mm, and dilation of cystic duct. It also provides an alternative when operative management is not available for patients in poor condition.

***Research perspectives***

In therapeutic failure, good gallbladder contraction function or dilation of cystic duct were not observed. However, the diameters of stones in fail cases were much greater than those of successful cases. This novel technique provided a feasible option for patients with concomitant gallstones and CBD stones. Prospective studies are needed for further confirmation.

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Grade D (Fair): 0

Grade E (Poor): 0

**Table 1 Baseline characteristics of patients**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No.** | **Gender /age** | **CBD/gallbladder** | | |
| **Number of stones** | **Diameter of the largest stone (mm)** | **Diameter of the largest balloon (mm)** |
| 1 | F/58 | 2/2 | 10/6 | 12/8 |
| 2 | M/45 | 3/1 | 15/7 | 16/8 |
| 3 | M/75 | 1/2 | 25/10 | 24/10 |
| 4 | F/67 | 1/1 | 20/8 | 20/8 |
| 5 | F/64 | 3/2 | 20/9 | 20/10 |
| 6 | M/68 | 2/2 | 21/10 | 20/10 |
| 7 | F/73 | 3/1 | 22/14 | 20/- |
| 8 | F/76 | 3/2 | 20/11 | 20/12 |
| 9 | M/86 | 2/1 | 21/10 | 20/10 |
| 10 | F/81 | 3/1 | 19/8 | 18/8 |
| 11 | F/67 | 1/2 | 20/10 | 20/10 |
| 12 | F/72 | 2/1 | 21/12 | 20/12 |
| 13 | M/76 | 2/3 | 18/15 | 18/- |
| 14 | F/65 | 3/1 | 18/12 | 18/12 |
| 15 | M/63 | 1/1 | 20/12 | 20/12 |

CBD: Common bile duct.

**Table 2 Operative parameters**

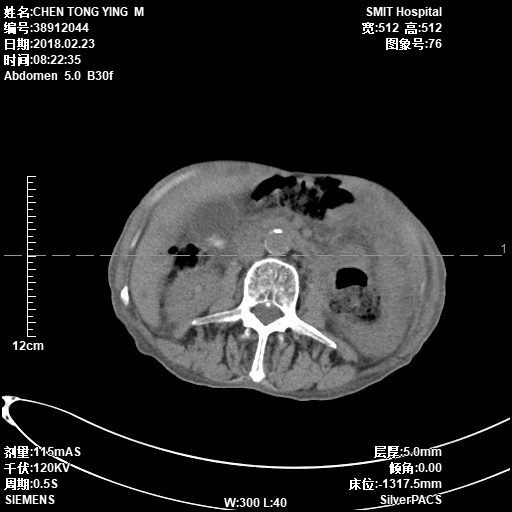
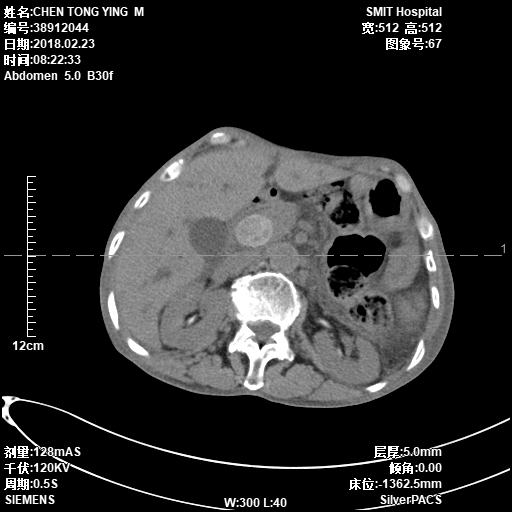
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No.** | **Primary technical success** | **Secondary technical success** | **Adverse events** | **Treatment** |
| 1 | Yes | Yes | No |  |
| 2 | Yes | Yes | Fever | Medication |
| 3 | Yes | Yes | No |  |
| 4 | Yes | Yes | No |  |
| 5 | Yes | Yes | abdominal distension | Medication |
| 6 | Yes | Yes | No |  |
| 7 | Yes | No | No |  |
| 8 | Yes | Yes | No |  |
| 9 | Yes | Yes | No |  |
| 10 | Yes | Yes | No |  |
| 11 | Yes | Yes | Abdominal pain | Medication |
| 12 | Yes | Yes | No |  |
| 13 | Yes | No | No |  |
| 14 | Yes | Yes | No |  |
| 15 | Yes | Yes | No |  |

**Table 3 Laboratory test of pre and post-intervention**

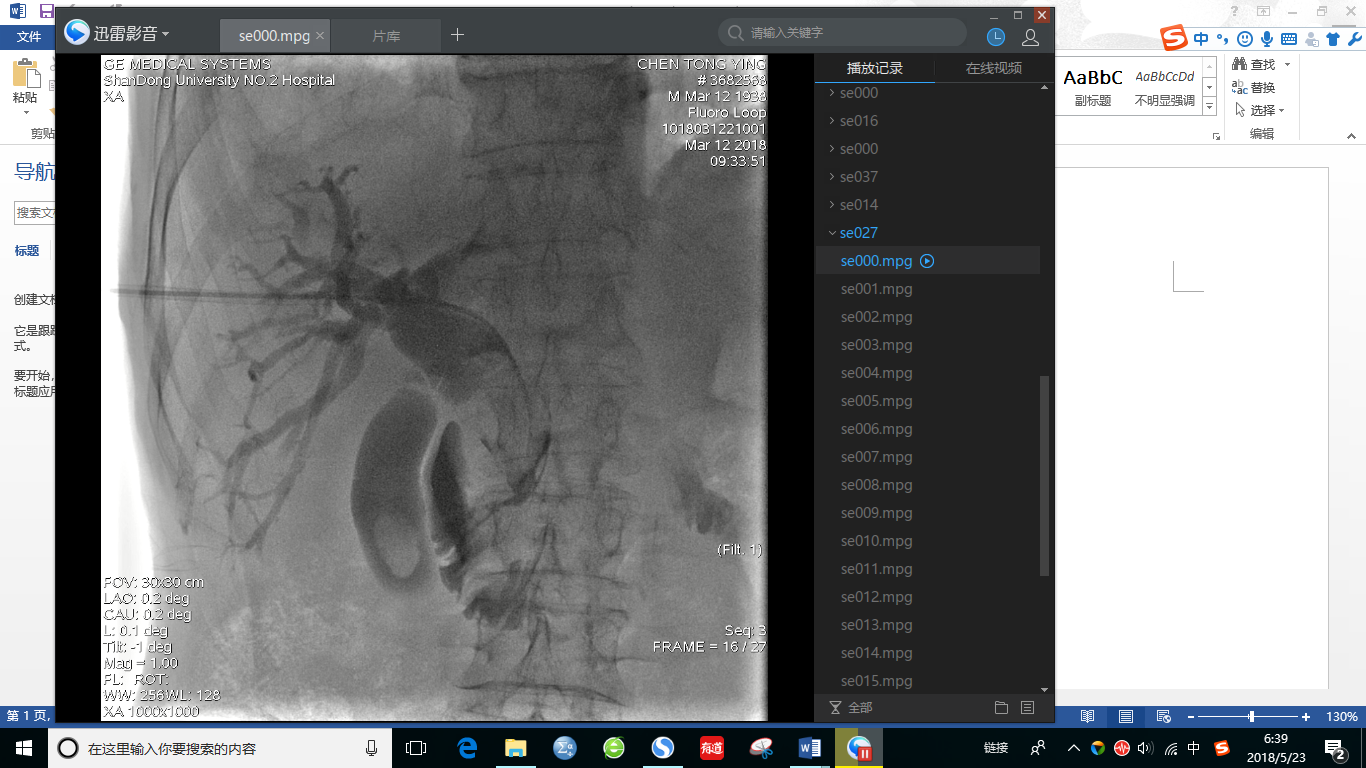
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Pre-intervention** | **2 wk after intervention** | ***t*** | ***P*** |
| ALT (U/L) | 98.93 ± 24.47 | 36.13 ± 8.99 | 10.41 | < 0.001 |
| TBIL (µmol/L) | 39.40 ± 7.76 | 21.47 ± 12.09 | 6.52 | < 0.001 |
| Amylase (U/L) | 80.73 ± 14.94 | 82.07 ± 17.77 | 0.34 | 0.741 |
| WBC (× 109/L) | 11.58 ± 1.45 | 7.65 ± 2.11 | 5.90 | < 0.001 |
| HGB (g/L) | 122.93 ± 8.66 | 118.80 ± 13.39 | 1.52 | 0.150 |

ALT: Alanine transaminase; HGB: Hemoglobin; TBIL: Total bilirubin; WBC: White blood cell

A B

C

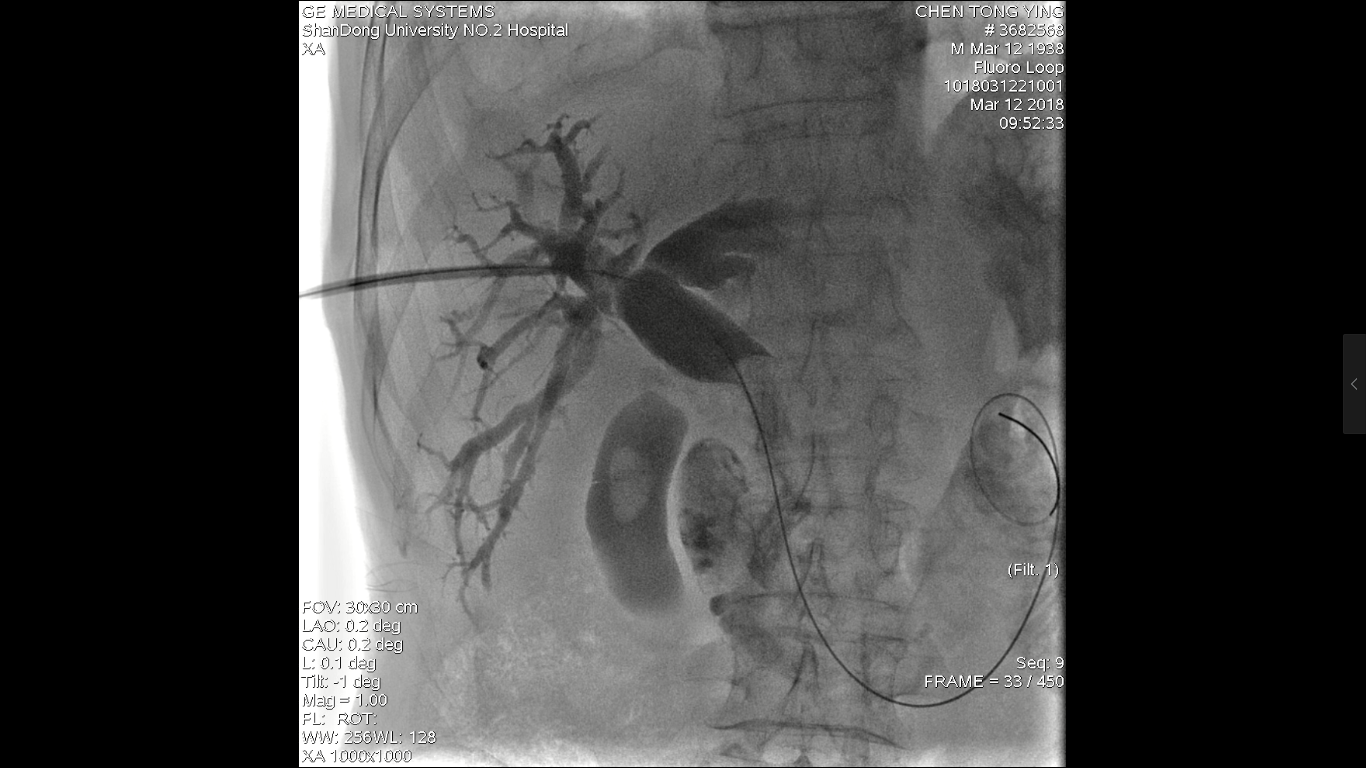


**Figure 1 Computed tomography scan and cholangiography showed filling defect in the common bile duct and gallbladder (white arrow).** Dilation of common bile duct and cystic duct were detected. A and B: Ultrasonography, enhanced CT, MRCP, or cholangiography was carried out to determine the diagnosis of stones; C: Advancing cholangiography was performed to detect the number, size, and location of stones. CT: Computed tomography; MRCP: Magnetic resonance cholangiopancreatography.

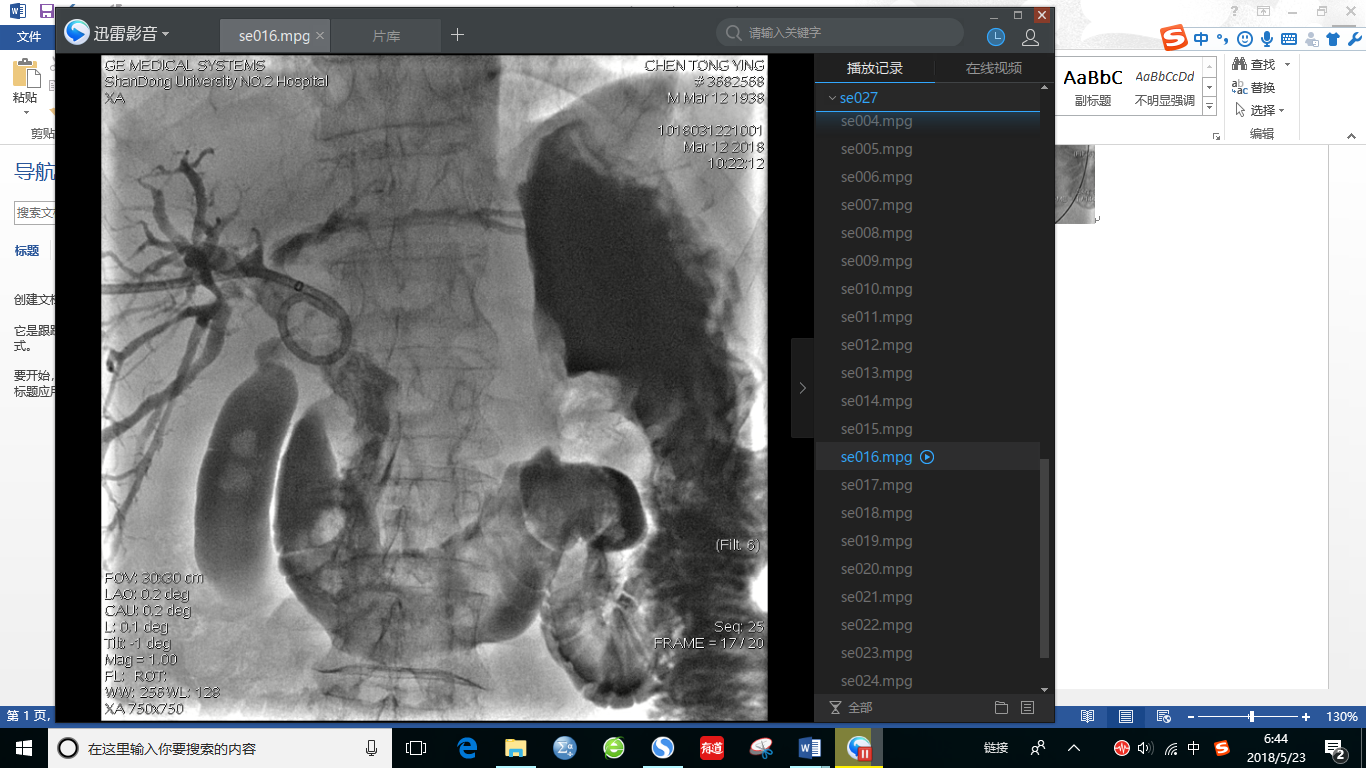


**Figure 2 Dilatation of the sphincter of oddi with balloon catheter was performed.**

A



B

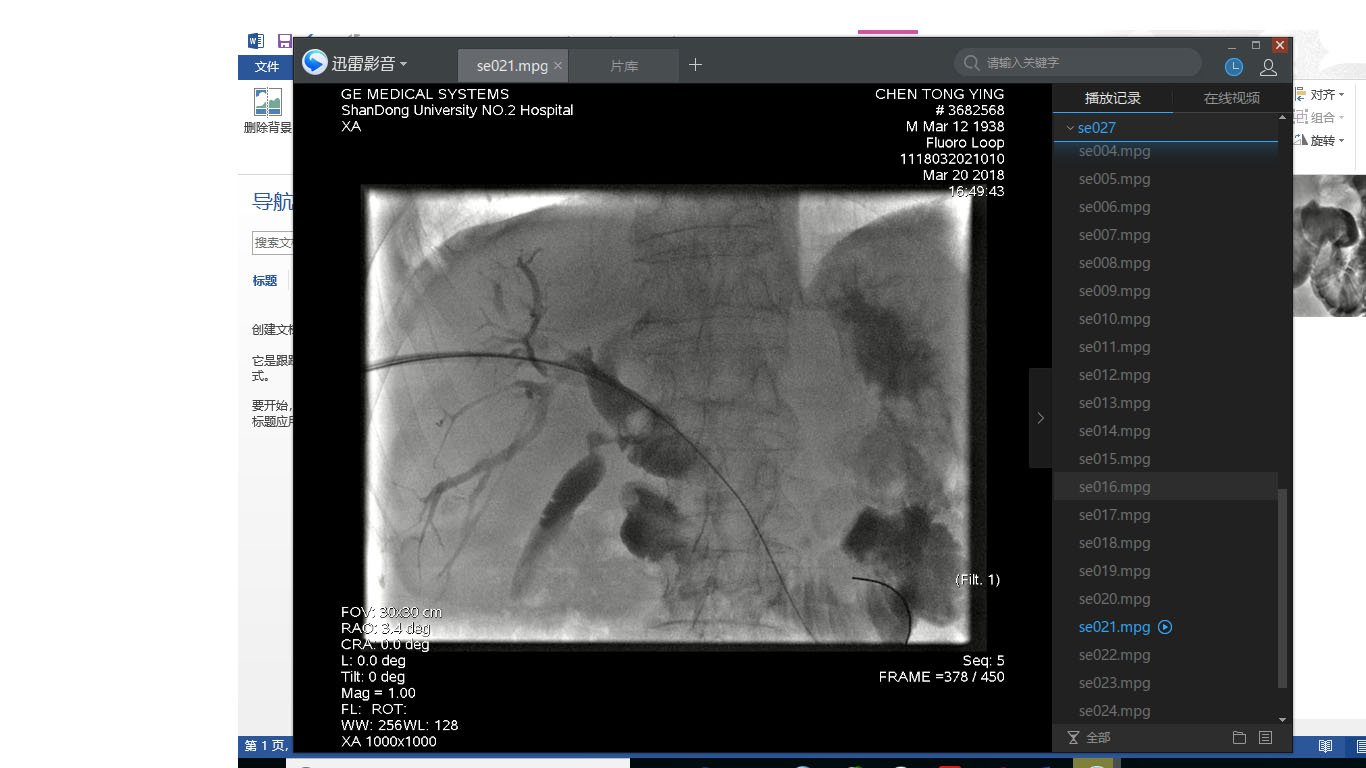


**Figure 3 Common bile duct stones were expelled into the duodenum through the dilated sphincter.** A and B: An 8.5F external drainage tube was deployed in the CBD for postoperative drainage and assessment of efficacy of the procedure. CBD: Common bile duct.



**Figure 4 Ursodeoxycholic acid was carried out and repeated cholangiography was performed.** The secondary common bile duct stones originating from gallbladder (white arrow) and shrinked gallbladder were detected by cholangiography.

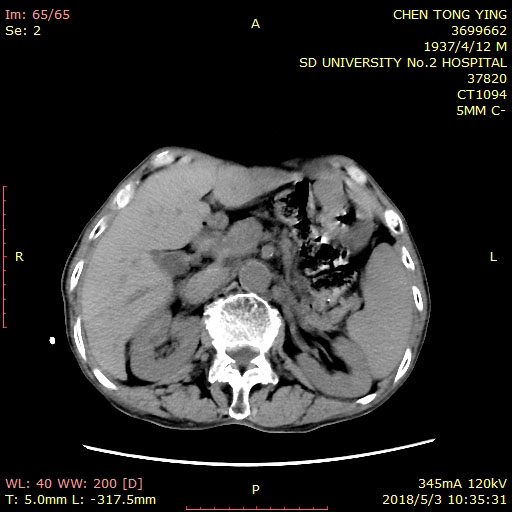
A



B



**Figure 5 Secondary common bile duct stones (white arrow) were expulsed into the duodenum without gallstone residual.** A and B: After 7-10 d, repeated cholangiography *via* external drainage catheter was performed, balloon dilation of the sphincter of oddi and elimination of stones was carried out in patients with secondary CBD stones. CBD: Common bile duct.

**Figure 6 Computed tomography and postoperative cholangiography demonstrated that there was no residual of common bile duct stones or gallstones.** A: Intraoperative cholangiography confirmed the absence of all stones and external drainage tube was left; B: Furthermore, 3-5 d after the procedure, cholangiography was performed again with no residual of stones, and the catheter was retrieved.